

**IN THE CLAIMS**

**1. (CURRENTLY AMENDED) A method to solve via poisoning for insulative porous low-k materials comprising the steps of:**

**providing a substrate having a first and a second insulative layers separated from each other by an intervening etch-stop layer formed therein said substrate;**

**forming a hole opening in said first and second insulative layers, including said intervening etch-stop layer;**

**forming a low-k protection layer over said second insulating layer, including in said hole opening, wherein said low-k protection layer prevents outgassing from said first and second insulative layers;**

**forming a trench opening over said hole opening to form a dual damascene structure, said hole opening containing said low-k protection layer;**

**forming a barrier layer on the vertical walls of said trench opening and on said low-k protection layer on the vertical walls of said hole opening;**

**forming a metal layer on said barrier layer in said dual damascene structure; and**

**performing chemical mechanical polishing (CMP), to complete the forming of**

**TS00-563**

**said dual damascene structure.**

**2. (ORIGINAL) The method of claim 1, wherein said first insulative layer is a low-k dielectric having a dielectric constant between about 2.0 to 3.0.**

**3. (ORIGINAL) The method of claim 1, wherein said first insulative layer has a thickness between about 2000 to 100000 Å.**

**4. (ORIGINAL) The method of claim 1, wherein said intervening etch-stop layer is silicon nitride.**

**5. (ORIGINAL) The method of claim 1, wherein said intervening etch-stop layer has a thickness between about 50 to 1000 Å.**

**6. (ORIGINAL) The method of claim 1, wherein said second insulative layer is a low-k dielectric having a dielectric constant between about 2.0 to 3.0.**

**7. (ORIGINAL) The method of claim 1, wherein said second insulative layer has a thickness between about 2000 to 100000 Å.**

**8. (PREVIOUSLY PRESENTED) The method of claim 1, wherein said low-k protection layer comprises SiO<sub>2</sub>, SiN, SiC or SiNC.**

**TS00-563**

**9. (ORIGINAL)** The method of claim 1, wherein said low-k protection layer has a thickness between about 20 to 1000 Å.

**10. (PREVIOUSLY PRESENTED)** The method of claim 1, wherein said barrier layer material is selected from the group comprising Ta, Ti, TaN, TiSiN, TaSiN, or WN.

**11. (ORIGINAL)** The method of claim 1, wherein said barrier layer has a thickness between about 30 to 500 Å.

**12. (ORIGINAL)** The method of claim 1, wherein said metal comprises copper.

**13. (CURRENTLY AMENDED)** A method to solve via poisoning for insulative porous low-k materials in a dual damascene structure comprising the steps of:

providing a substrate having a passivation layer formed over a first metal layer formed on said substrate;

forming a first insulative layer over said substrate;

forming an etch-stop layer over said first insulative layer;

forming a second insulative layer over said etch-stop layer;

forming a first photoresist layer over said second insulative layer and patterning said photoresist to form a first photoresist mask having a hole pattern;

etching said first and second insulative layers, including said etch-stop layer through said hole pattern to form a hole opening in said first and second insulative layers and reaching said passivation layer;

removing said first photoresist mask ~~from said second insulative layer~~;

~~forming a low-k protection layer over said substrate on said second insulative layer, including in said hole opening;~~

forming a low-k protection layer in said hole opening in said first and second insulative layers, including over said substrate;

forming a second photoresist layer over said substrate, including over said hole opening having said low-k protection layer and patterning said second photoresist to form a second photoresist mask having a trench pattern; .

etching said second insulative layer through said trench pattern in said second photoresist mask to form a trench in said second insulative layer, thus completing the forming of said dual damascene structure in said substrate;

TS00-563

removing said second photoresist mask;

removing said low-k protection layer from over said substrate and from the bottom of said hole opening and thereby exposing underlying said passivation layer while leaving said low-k protection layer on the vertical sides of said hole opening;

removing said passivation layer from said bottom of said hole opening, thereby exposing underlying said first metal layer;

forming a barrier layer over said substrate, including in said dual damascene structure, wherein said barrier layer conforms to said low-k protective layer in said hole opening and conforms to said trench in said second insulative layer;

depositing a second metal over said barrier layer in said dual damascene structure; and

performing chemical mechanical polishing (CMP) to complete the forming of said dual damascene structure.

14. (ORIGINAL) The method of claim 13, wherein said substrate is silicon.

TS00-563

15. (ORIGINAL) The method of claim 13, wherein said passivation layer comprises silicon nitride (SiN).

16. (ORIGINAL) The method of claim 13, wherein said passivation layer has a thickness between about 30 to 1000 Å.

17. (ORIGINAL) The method of claim 13, wherein said first insulative layer is a low-k dielectric having a dielectric constant between about 2.0 to 3.0.

18. (ORIGINAL) The method of claim 13, wherein said first insulative layer has a thickness between about 2000 to 100000 Å.

19. (ORIGINAL) The method of claim 13, wherein said intervening etch-stop layer is silicon nitride.

20. (ORIGINAL) The method of claim 13, wherein said intervening etch-stop layer has a thickness between about 30 to 1000 Å.

21. (ORIGINAL) The method of claim 13, wherein said second insulative layer is a low-k dielectric having a dielectric constant between about 2.0 to 3.0.

22. (ORIGINAL) The method of claim 13, wherein said second insulative layer has a thickness between about 2000 to 100000 Å.

23. (ORIGINAL) The method of claim 13, wherein said etching said first and second insulative layers is accomplished with a recipe comprising  $C_2F_6$ ,  $C_4F_3$ , Ar,  $N_2$  and  $O_2$ .

24. (ORIGINAL) The method of claim 13, wherein said etching said etch-stop layer is accomplished with a recipe comprising  $C_2F_6$ ,  $C_4F_3$ , Ar,  $N_2$  and  $O_2$

25. (PREVIOUSLY PRESENTED) The method of claim 13, wherein said low-k protection layer material is selected from the group comprising  $SiO_2$ , SiN, SiCN or SiC.

26. (ORIGINAL) The method of claim 13, wherein said low-k protection layer has a thickness between about 30 to 1000 Å.

27. (ORIGINAL) The method of claim 13, wherein said removing said low-k protection layer is accomplished with a recipe comprising  $C_2F_6$ ,  $C_4F_3$ , Ar,  $N_2$  and  $O_2$ .

28. (PREVIOUSLY PRESENTED) The method of claim 13, wherein said barrier layer material is selected from the group comprising Ta, Ti, TaN, TiSiN, TaSiN, or WN.

TS00-563

29. (ORIGINAL) The method of claim 13, wherein said barrier layer has a thickness between about 30 to 500 Å.

30. (ORIGINAL) The method of claim 13, wherein said second metal comprises copper.